SOLUTIONS MANUAL FOR

Electric Power Distribution Engineering

THIRD EDITION

by

Turan Gönen

CRC Press
Taylor & Francis Group

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2-16

$$D_g = \frac{\left(\sum_{i=1}^{12} TCD_i\right) \times DF_i}{F_D} = \frac{\sum_{i=1}^{12}(20\text{ kW} \times 0.6)}{1.15} = \frac{12 \times 20 \times 0.6}{1.15} = 125.2\text{ kW}$$

2-17 (a)

$$\text{Annual } P_{avg} = \frac{100{,}000{,}000\text{ kWh/yr}}{8760\text{ h/yr}} = 11{,}415{,}5\text{ kW}$$

or

$$\text{Monthly energy} = \frac{100{,}000{,}000\text{ kWh/yr}}{12\text{ mos/yr}} = 8{,}333{,}333.3\text{ kWh}$$

$$\text{Avg. monthly demand} = \frac{8{,}333{,}333.3\text{ kWh}}{730\text{ h/mo}} = 11{,}415.5\text{ kW}$$

$$F_{LD} = \frac{\text{Ann. avg. load}}{\text{Peak monthly demand}}$$

(b) $$\text{Max. monthly demand} = \frac{\text{Ann. avg. load}}{F_{LD}} = \frac{11{,}415.5\text{ kW}}{0.6} \cong 19{,}026\text{ kW}$$

Note that, max means peak here.

2-18 (a)

$$D_{FD} = \frac{900 + 1000 + 2100 + 2000}{D_g} = 1.25 \Rightarrow D_g = \frac{6{,}000}{1.25} = 4{,}800\text{ kW} = P$$

$$PF_1 = \cos\theta_1 = 0.85 \Rightarrow \theta_1 = 31.79^\circ$$

$$PF_2 = \cos\theta_2 = 0.9 \Rightarrow \theta_2 = 25.84^\circ$$

$$PF_3 = \cos\theta_3 = 0.95 \Rightarrow \theta_3 = 18.2^\circ$$

$$PF_4 = \cos\theta_4 = 0.9 \Rightarrow \theta_4 = 25.84^\circ$$

$$Q = \frac{\sum_{i=1}^{4} P_i \times \tan\theta_i}{F_D} = \frac{900\tan 31.79^\circ + 1000\tan 25.84^\circ + 2100\tan 18.2^\circ + 2000\tan 25.84^\circ}{1.25}$$

$$= \frac{2{,}701.09}{1.25} \cong 2{,}160.87\text{ kvar}$$

$$S = \left(P^2 + Q^2\right)^{1/2} = \left(4800^2 + 2{,}160.87^2\right)^{1/2} \cong 5{,}264\text{ kVA which is also } D_g \text{ in kVA}$$

(b) $$LD = \sum_{i=1}^{4} D_i - D_g = 6000 - 4{,}800 = 1{,}200\text{ kW}$$

(*c*) Since $(4687\text{ kVA})1.25 = 5{,}858.75\text{ kVA} > 5{,}264\text{ kVA}$

choose 3750/4687 kVA transformer.